ControlSpace® ESP-88
Engineered Sound Processor

TECHNICAL DATA SHEET

Product Overview

A powerful digital signal processor that provides control and audio processing in a single, expandable unit. The system integrates easily with popular facility control devices and IT systems, and features simple and elegant user interfaces that provide operation for a variety of system applications.

The ControlSpace® ESP-88 system provides a comprehensive and expandable DSP solution. It ships as an eight-input and eight line-level output system and is expandable to 64 audio channels.

Recent Enhancements

- Automatic microphone mixing providing gating, priority and NOM attenuation for sound reinforcement systems using multiple active microphone inputs.
- Optional surround sound expansion card, which decodes Dolby® Digital, DTS® and PCM audio formats, eliminating the need for an external decoder, and integrating all the audio processing within the ESP-88.
- Expanded Serial Protocol to enable the ControlSpace system to work with popular third-party control devices.

Product Information

The ControlSpace ESP-88 engineered sound processor has a complete set of audio-processing algorithms, a flexible signal path and expandable card architecture that make it an excellent solution for most engineered sound applications.

For larger applications, optional audio expansion cards can be added, and an optional DSP expansion card can increase processor power and delay memory by 4x. Multiple ESP-88 processors can be utilized.

The ControlSpace ESP-88 processor supports multiple choices of user control interfaces, including the ControlSpace CC-4 room controller, CC-16 zone controller and CC-64 control center.

The ControlSpace Designer™ software (included) is used to configure the ControlSpace ESP-88 processor and the user interfaces. The Smart Simulation programming allows immediate testing of the functionality to verify all control programming. The software runs on a PC and communicates with the system over Ethernet.

Key Features

- Eight mic/line inputs and eight line outputs
- Eight control inputs and eight control outputs
- Low latency (610 microseconds analog in to analog out)
- Flexible cardframe architecture
- Supported algorithms include: automatic microphone mixing, compressor/limiter, crossover, delay, filters, gain/mute, graphic EQ, matrix mixer, meters, mixer, noise/tone generators, noise gate, parametric EQ, router, Bose® speaker EQ and crossovers, ducker, automatic gain control and source selectors
- Real-time clock for scheduling events by time of day or day of week
- Password protection of design files
- Parameter sets allow one system to provide different scenes and operation in separate rooms or zones
- RS-485 port for connecting up to 15 ControlSpace CC-16 zone controllers

Applications

The ControlSpace ESP-88 engineered sound processor is well-suited for:

- Houses of worship
- Multipurpose facilities
- Hospitality
- Retail
- Sports venues
- Schools
- Auditoriums

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Detailed Product Specifications

INPUTS

8 analog, electronically balanced, microphone/line-level (software selectable), Phoenix/Euro block 2-piece, 3-pin connectors

Nominal input level	+4 dBu/-10 dBu/-20 dBu/-38 dBu/ -44 dBu/-50 dBu/-60 dBu
Input impedance	2.4 kΩ @ 1 kHz (with or without phantom power active)
Maximum input level	+24 dBu at +4 dBu nominal input level
Equivalent input noise	-115 dB at -60 dBu nominal input level (A-weighted/20 Hz – 20 kHz)
Dynamic range	104 dB (typical) at +4 dBu nominal input level (A-weighted/20 Hz – 20 kHz)
Phantom power	+15V nominal selectable per input

OUTPUTS

8 analog, electronically balanced, Phoenix/Euro block 2-piece, 3-pin connectors

Nominal output level	+4 dBu
Output impedance	200Ω (600Ω load expected)
Frequency response	20 Hz to 20 kHz (+0.5 dB/-2.0 dB) at +4 dBu nominal output level
Maximum output level	+24 dBu
SNR	80 dB at +4 dBu nominal output level (A-weighted/20 Hz – 20 kHz)
Residual output noise	-110 dBu at output muted (A-weighted/20 Hz – 20 kHz)
THD+N	0.01% at +4 dBu nominal input and output level (A-weighted/20 Hz – 20 kHz)
Crosstalk	< -90 dB at +4 dBu nominal input and output level 1 kHz

SIGNAL PROCESSING

32-bit floating-point digital signal processor(s), 200 MHz

Maximum calculation	1600MIPS/1200MFLOPS (6400MIPS/ 4800MFLOPS with optional DSP expansion card)
Delay memory	16MByte/72s (64MByte/288s with optional DSP expansion card)

SIGNAL PROCESSING *(continued)*

Audio latency	610µs (analog in to analog out); (860µs with DSP option card)
Sampling rate	48 kHz
A/D and D/A converters	24-bit

CONTROL INPUTS

8 analog or digital inputs, 5.1 kΩ internal pull-up resistor to 5V, Phoenix/Euro block 2-piece, 9-pin 3.81mm pitch connectors

Analog input voltage range	0V to 3.3V (maximum 5V)
Digital input voltage range	0V to 3.3V (threshold voltage = 1.6V)

CONTROL OUTPUTS

8 digital outputs, 10 kΩ internal pull-up resistor to 5V, Phoenix/Euro block 2-piece, 9-pin 3.81mm pitch connectors

Output voltage	0 to 5V open collector
Output current	0.5mA (Source)/10mA max (Sink)
COMMUNICATION PORTS	10Base-T (RJ-45), RS-232C (D-Sub 9-pin, male, DTE), RS-485 (Phoenix/Euro block 2-piece, 3-pin)
STATUS INDICATORS	Power/Status/Ethernet/Serial (RS-232C + RS-485)
AUDIO INDICATORS	Signal (Present/Normal/Clip) for each audio input and output
EXPANSION SLOTS	8 audio (4 occupied), 2 control (1 occupied), 1 DSP
AUDIO CHANNELS	32 maximum analog or 64 maximum digital (AES-3)
MAINS VOLTAGE	85-264VAC 50/60 Hz with PFC
POWER CONSUMPTION	< 35VA typical < 70VA max at < 35C ambient
DIMENSIONS	18.9" x 3.46" x 13" (482mm x 88mm x 332mm)
WEIGHT	11.6lb (5.3kg)
OPERATING TEMPERATURE	35ºC Max

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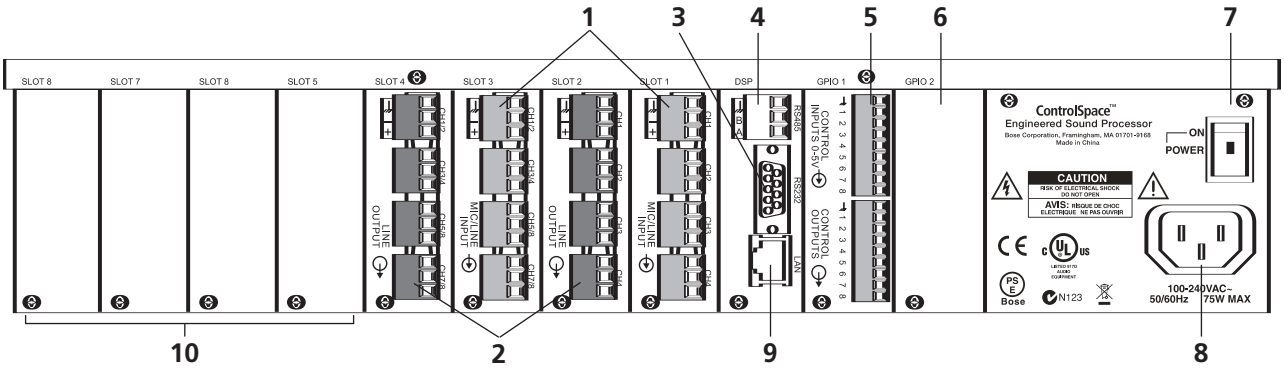
Rear Panel Drawing



1 **MIC/LINE INPUTS** – Four balanced mic/line inputs (audio input connectors are green) in slots 1 and 3. These are inputs S1-1 through S1-4, and S3-1 through S3-4 in the ControlSpace® Designer™ software.

2 **LINE OUTPUTS** – Four balanced line outputs (audio output connectors are orange) in slots 2 and 4. These are outputs S2-1 through S2-4 and S4-1 through S4-4 in the Designer software.

3 **RS-232C CONNECTOR** – DB-9 male (DTE).

4 **RS-485 CONNECTOR** – Connect ControlSpace CC-16 controllers.

5 **GPIO CARD** – Eight general-purpose control inputs, eight general-purpose control outputs.

6 **GPIO SLOT 2** – For optional second GPIO card.

7 **POWER SWITCH** – ON/OFF AC power.

8 **AC CORD INLET** – Connect the AC cord appropriate for your area.

9 **ETHERNET LAN CONNECTOR** – Connect to your PC with enclosed crossover cable. Or, connect directly to a hub or router with a straight-through cable.

10 **AUDIO SLOTS 5-8** – For optional audio cards.

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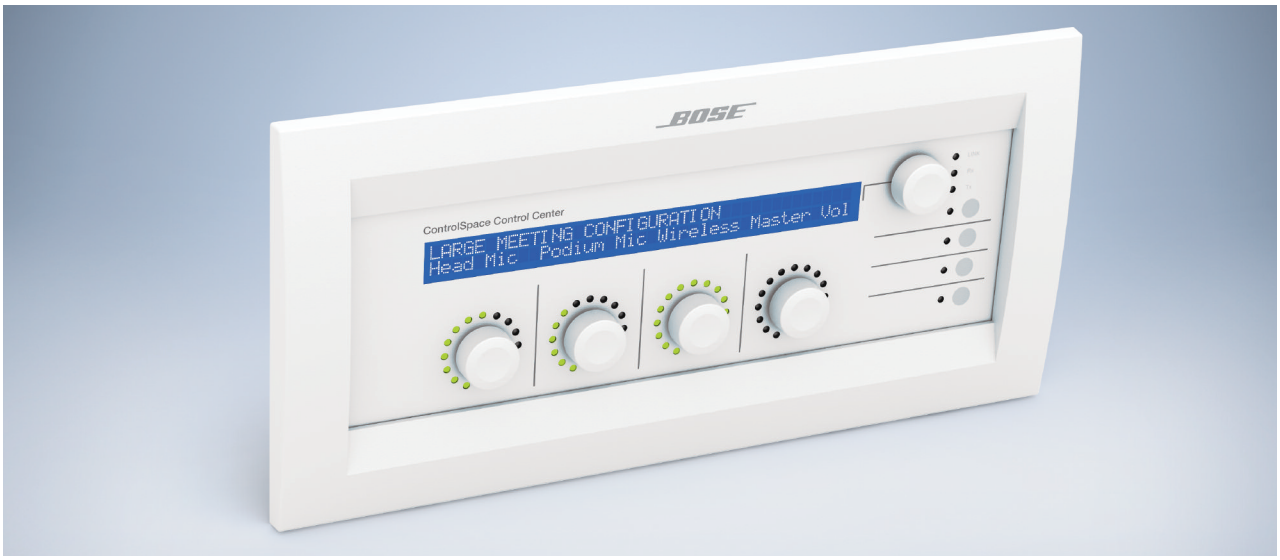
ControlSpace® ESP-88 Controllers

ControlSpace CC-4 Room Controller
Direct-wired to ESP-88 GPI port. Includes 4-position switch and 10k ohm potentiometer.

PC 042023

ControlSpace CC-16 Zone Controller
RS-485-based, wall-mount user control facilitates simplified system operation. Mounts in a standard 2-gang wall box.

PC 041761



ControlSpace CC-64 Control Center
Ethernet-based control center for complete control of any ControlSpace system. Mounts in a standard 5-gang wall box.

PC 041760

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ControlSpace® Designer™ Software

The Bose® ControlSpace® Designer™ software is a graphical user interface tool for designing and configuring a ControlSpace system. Smart Simulation programming enables designers to observe, verify, iterate and document the programming of all the ControlSpace ESP-88 sound processors, control centers, zone controllers and general-purpose inputs – on screen – whether connected to the system hardware or not.

Smart Simulation also allows designers to work more interactively with their customers. They can easily demonstrate system operation so customers see the actual screen text and display of all controls – before they are installed.

Drag-and-drop design interface offers designers the flexibility to:

- Quickly, accurately and easily configure the ESP-88 engineered sound processor.
- Connect processing blocks in any order or pattern to suit the installation.
- Easily place, copy/paste, paste-to-all and undo inputs, outputs, EQ settings, speaker settings and connections.

Visual cues let designers clearly see muting, inverted signals and other information to easily verify and troubleshoot system functions – before arriving at the site. And with no compile time, designers can experience changes in real time.

On-screen buttons/knobs allow designers to build, operate and adjust the controls while working with a customer to create intuitive user controls. Parameter sets allow one system to provide different functions and operation in separate rooms or areas. Presets, parameter sets and groups provide the ability to program and recall systems changes ranging from an individual parameter to a complete system setup.

Uses standard Ethernet protocols, allowing for high-speed and industry-standard PC control and configuration. Available screen views include Project and ESP-88 view.

The software also includes EQs and crossovers for all Bose professional speakers.

ControlSpace ESP-88 Engineered Sound Processor Expansion Cards

ControlSpace surround sound decoder input card — PC 302210
Occupies one slot. One optical input and one coaxial S/PDIF input (software selectable).

ControlSpace DSP expansion card — PC 041769
Daughtercard for main DSP card. Increases performance by 300%. One card can be added to an ESP-88.

ControlSpace 4x4 mic/line input/output Series II card — PC 041915
Occupies two audio slots. Four microphone or line-level inputs (software-selectable), and four line-level outputs. The ESP-88 includes two 4x4 mic/line cards. Two 4x4 cards can be added.

ControlSpace four-channel mic/line input card — PC 041917
Occupies one audio slot. Four microphone or line-level inputs (software-selectable).

ControlSpace GPIO card — PC 041768
Fits in one of the two GPIO slots and adds eight control inputs and eight control outputs. One GPIO card can be added to an ESP-88.

ControlSpace EDR line-level output card — PC 041763
Occupies one audio slot. Four highest-quality, line-level outputs.

ControlSpace EDR line-level input card — PC 041764
Occupies one audio slot. Four highest-quality, line-level inputs.

ControlSpace AES-3 eight-channel input card — PC 041765
Occupies one audio slot. Eight AES-3 inputs (two per input connector).

ControlSpace AES-3 eight-channel output card — PC 041766
Occupies one audio slot. Eight AES-3 outputs (two per output connector).

ControlSpace four-channel SDR output card — PC 041916
Occupies one audio slot. Four line-level outputs.

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Engineers' and Architects' Specifications

The engineered sound processor shall be a DSP-based signal processor. The processor shall include eight general-purpose control outputs and eight general-purpose inputs with expansion capabilities for up to a total of 16 general-purpose control outputs and 16 general-purpose inputs.

Analog audio inputs and outputs shall be electronically balanced. The maximum input and output levels shall be +24 dBu. Analog inputs shall be software-switchable between microphone and line-level inputs. Phantom power of +15V shall be provided. A/D and D/A sections shall be 24-bit, 64x over-sampled.

The processor shall include eight analog audio inputs and eight analog audio outputs, but be expandable to a total of 64 audio channels in one 2U frame. The digital signal processing shall be performed by a Texas Instruments™ brand TMS320C6713 DSP chip running at 200 MHz and utilizing 128Mbit of RAM for delay. All processing shall be done with 32-bit resolution, and audio sampling shall be at 48 kHz.

The processor shall include Ethernet, RS-232 and RS-485 ports. Certifications shall include cUL, C-Tick and IEC60065, and have a CB report including all country deviations. Processor and peripherals shall meet EN55103-1 and EN55103-2 EMC requirements.

The system shall include PC-based design and control and configuration software, and communicate with the DSP and other parts of the system via Ethernet with full IP addressability and password protection.

The processor and design software shall include the following minimum set of processing modules: Bose® speaker EQs, Bose crossovers, crossovers, graphic and parametric EQs, routers, delays, matrix mixers, automatic microphone mixer, signal generators, meters, compressor/limiters, duckers, automatic gain controls, gate, room combiner and source selectors.

All signal processing modules, parameter sets, presets and groups shall be directly controllable by third-party devices via the RS-232 port. It shall also be possible to designate signal processing modules in the design file for which asynchronous RS-232 feedback is requested.

The processor shall be capable of using a variety of audio cards, including a 4x4 mic/line input/output card, a four-channel enhanced dynamic range output card, a four-channel enhanced dynamic range input card, AES-3 eight-channel input and output cards, a four-channel mic/line input card and a four-channel output card. Unit also shall support addition of a GPIO expansion card to increase the system's general-purpose inputs and outputs to 16 each. Processor shall support a DSP expansion card, which includes three Texas Instruments TMS320C6713 DSPs running at 200 MHz and three 128Mbit RAMs for delay.

Processor shall also support a surround sound card, capable of decoding Dolby® Digital, DTS® and PCM audio formats.

The processor shall support up to 15 RS-485-based zone controllers, eight Ethernet-based control centers and two GPI-based room controllers.

The engineered sound processor shall be the Bose ControlSpace® ESP-88 engineered sound processor.

Safety and Regulatory Compliance

The ControlSpace ESP-88 processor meets cUL (UL 60065 7th edition), C-Tick, PSE and IEC/EN 60065 7th edition, and has a CB report including all country deviations. It meets FCC Class B, Canadian ICES-003 Class B and EN55103-1 and EN55103-2 EMC requirements.

Limited Warranty

The ControlSpace ESP-88 engineered sound processor is covered by a transferable five-year limited warranty.

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Product Codes

ControlSpace ESP-88 120V – US	PC 041755
ControlSpace ESP-88 230V – EU	PC 041756
ControlSpace ESP-88 100V – JPN	PC 041757
ControlSpace ESP-88 240V – UK/Sing	PC 041758
ControlSpace ESP-88 240V – AU	PC 041759
ControlSpace CC-64 control center	PC 041760
ControlSpace CC-16 zone controller	PC 041761
ControlSpace CC-4 room controller	PC 042023
ControlSpace accessory power supply	PC 041762

Expansion Cards

ControlSpace DSP expansion card	PC 041769
ControlSpace 4x4 mic/line input/output Series II card	PC 041915
ControlSpace four-channel SDR output card	PC 041916
ControlSpace four-channel mic/line input card	PC 041917
ControlSpace GPIO card	PC 041768
ControlSpace EDR four-channel line output card	PC 041763
ControlSpace EDR four-channel line input card	PC 041764
ControlSpace AES-3 eight-channel input card	PC 041765
ControlSpace AES-3 eight-channel output card	PC 041766
ControlSpace surround sound decoder input card	PC 302210

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